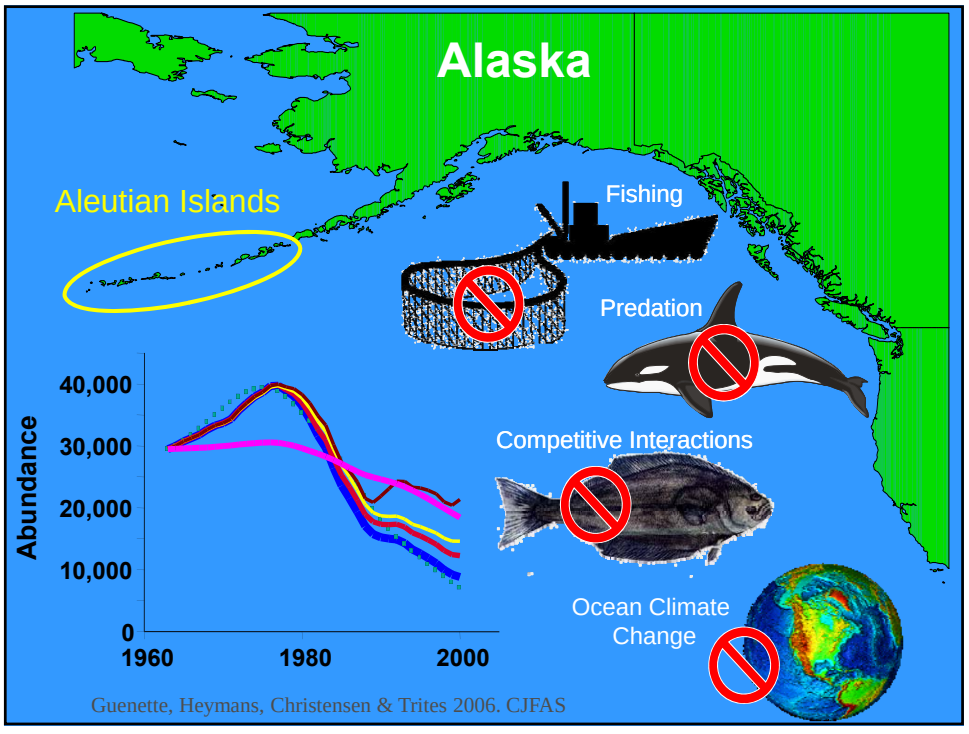
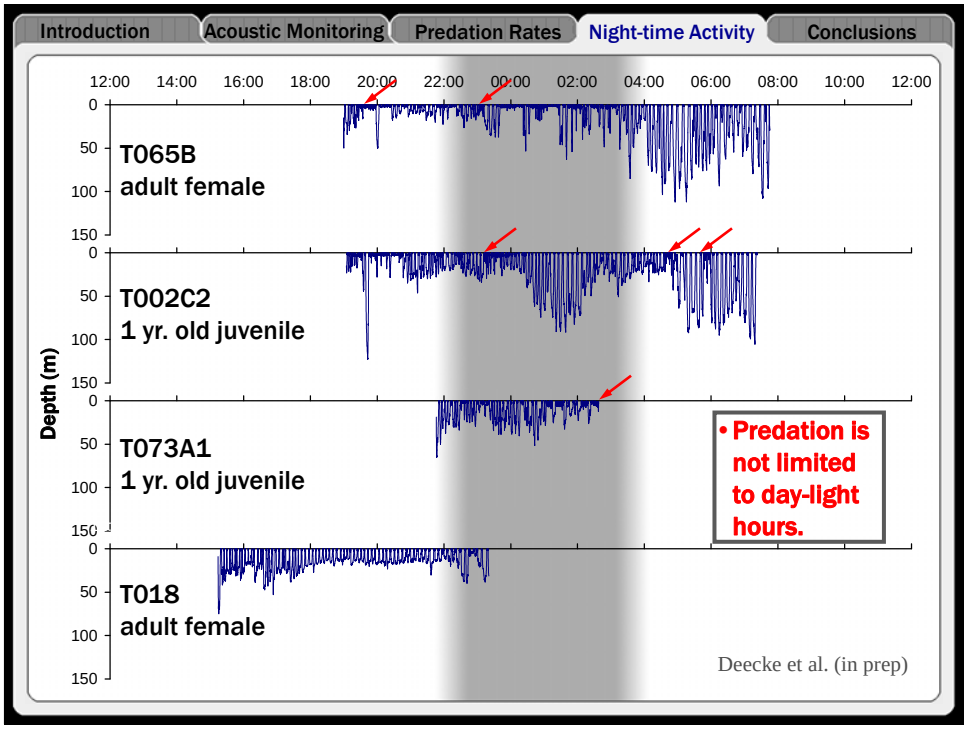
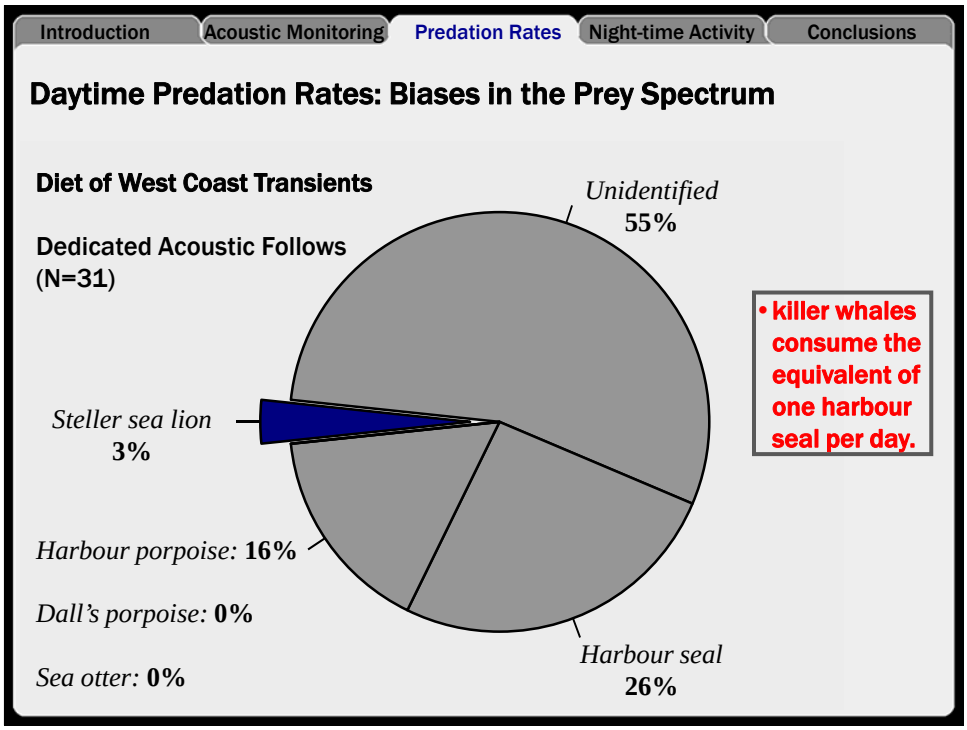
Steller sea lion decline perspectives

Andrew W Trites

North Pacific Universities Marine Mammal Research Consortium

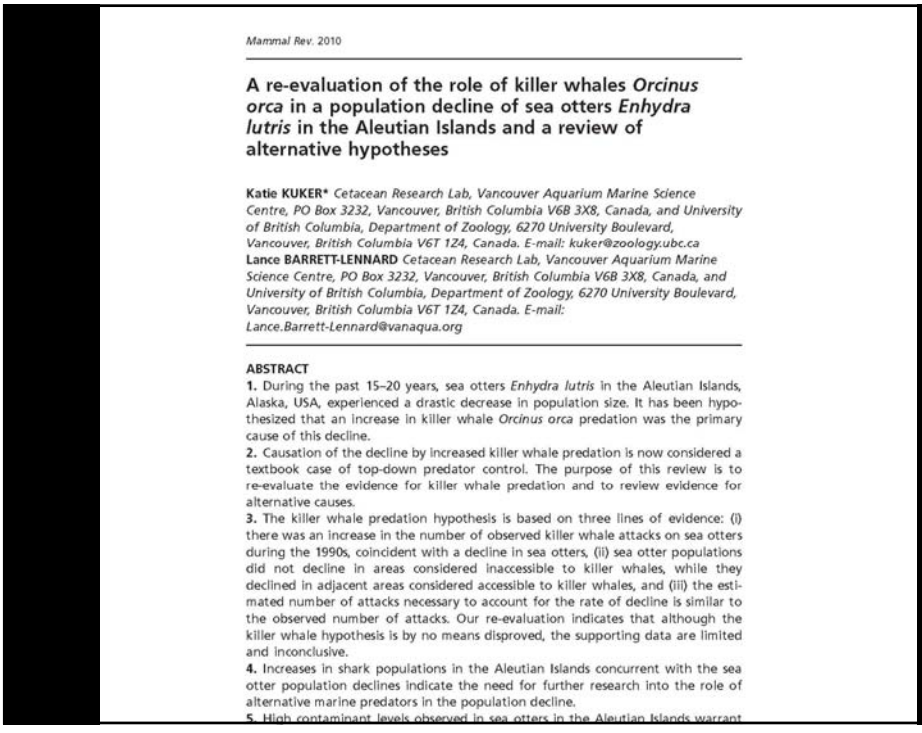



Introduction
Acoustic Monitoring
Predation Rates
Night-time Activity
Conclusions
12:00
14:00
16:00
18:00
20:00
22:00
00:00
02:00
04:00
06:00
08:00
10:00
12:00
Depth (m)
T065B
adult female
T002C2
1 yr. old juvenile
T073A1
1 yr. old juvenile
T018
adult female
• Predation is not limited to day-light hours.
Deecke et al. (in prep)


Introduction
Acoustic Monitoring
Predation Rates
Night-time Activity
Conclusions
Daytime Predation Rates: Biases in the Prey Spectrum
Diet of West Coast Transients
Dedicated Acoustic Follows
(N=31)
Unidentified
55%
Steller sea lion
3%
Harbour porpoise: 16%
Dall's porpoise: 0%
Sea otter: 0%
Harbour seal
26%
• killer whales consume the equivalent of one harbour seal per day.

Predation?

- Likely *in*significant at *high* populations
- But *very* significant when populations are *low*
- Rates of predation likely vary by region of Alaska



Mammal Rev. 2010

A re-evaluation of the role of killer whales *Orcinus orca* in a population decline of sea otters *Enhydra lutris* in the Aleutian Islands and a review of alternative hypotheses

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ABSTRACT

1. During the past 15–20 years, sea otters *Enhydra lutris* in the Aleutian Islands, Alaska, USA, experienced a drastic decrease in population size. It has been hypothesized that an increase in killer whale *Orcinus orca* predation was the primary cause of this decline.

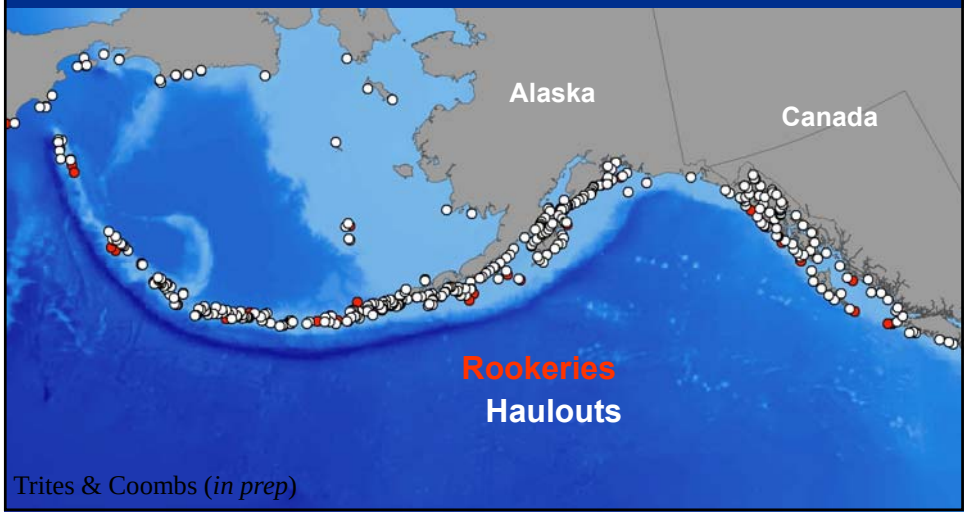
2. Causation of the decline by increased killer whale predation is now considered a textbook case of top-down predator control. The purpose of this review is to re-evaluate the evidence for killer whale predation and to review evidence for alternative causes.

3. The killer whale predation hypothesis is based on three lines of evidence: (i) there was an increase in the number of observed killer whale attacks on sea otters during the 1990s, coincident with a decline in sea otters, (ii) sea otter populations did not decline in areas considered inaccessible to killer whales, while they declined in adjacent areas considered accessible to killer whales, and (iii) the estimated number of attacks necessary to account for the rate of decline is similar to the observed number of attacks. Our re-evaluation indicates that although the killer whale hypothesis is by no means disproved, the supporting data are limited and inconclusive.

4. Increases in shark populations in the Aleutian Islands concurrent with the sea otter population declines indicate the need for further research into the role of alternative marine predators in the population decline.

5. High contaminant levels observed in sea otters in the Aleutian Islands warrant

Steller sea lion haulouts are breeding locations for non-pregnant females

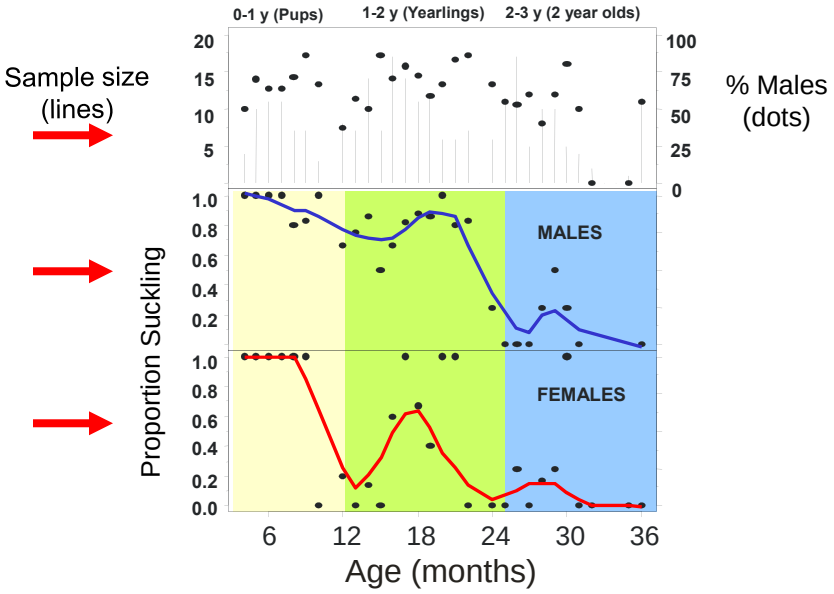


Trites & Coombs (*in prep*)

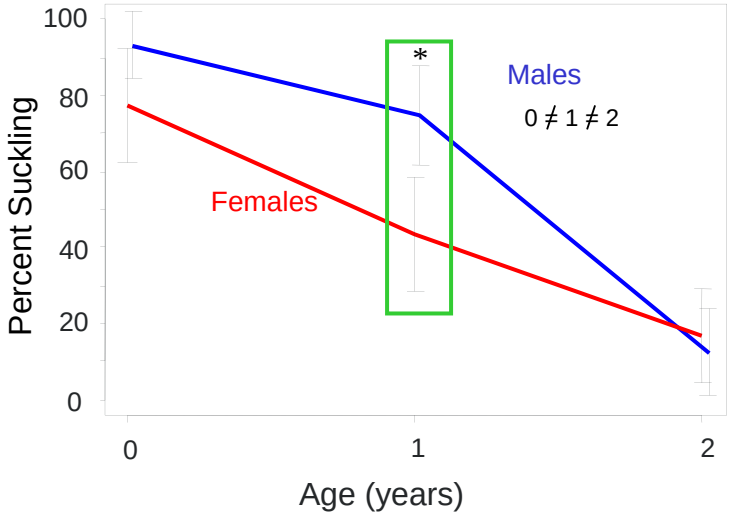
Weaning: *in summer, not winter!*

@ 1, 2, or 3 y

Sample size and proportion suckling



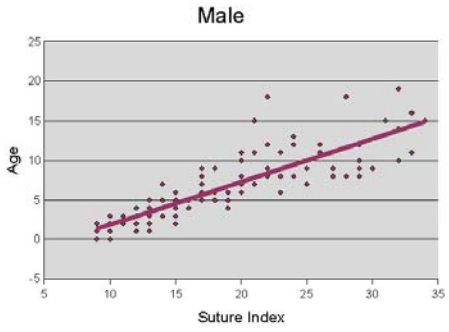
% branded animals observed suckling



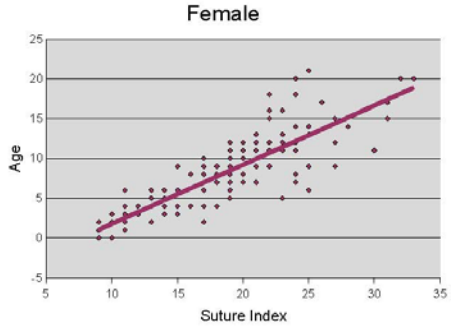
Skulls Measured

Total	males	females	
688	343	345	skulls accessed
597	283	314	skulls with info (sex, location, date)
268	135	133	skulls of known age

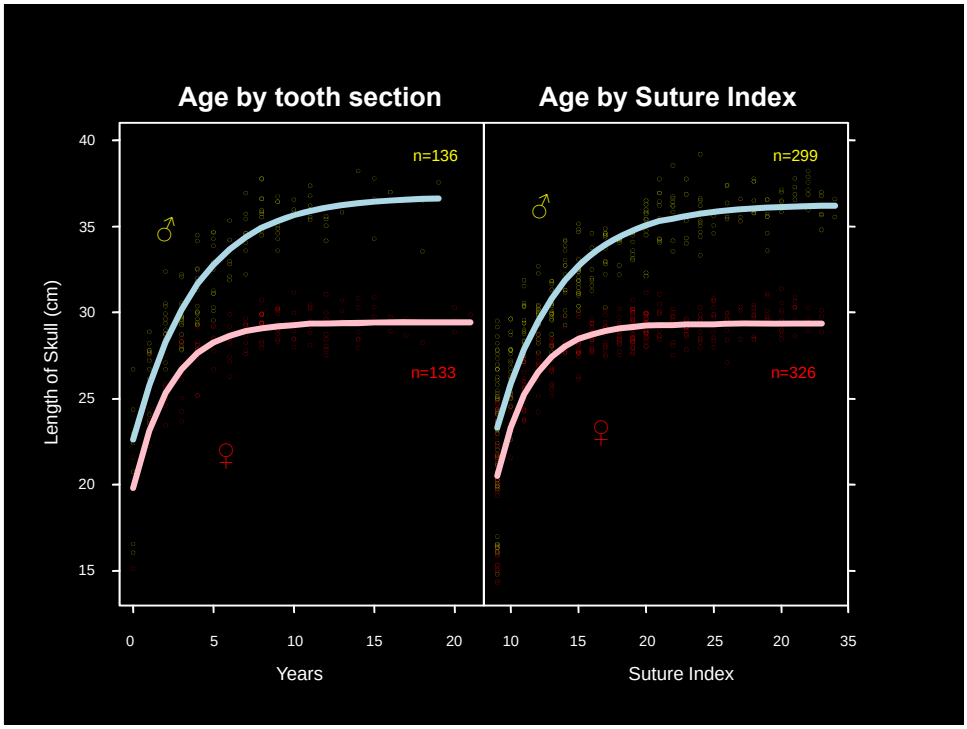
Isono et al. (in prep)

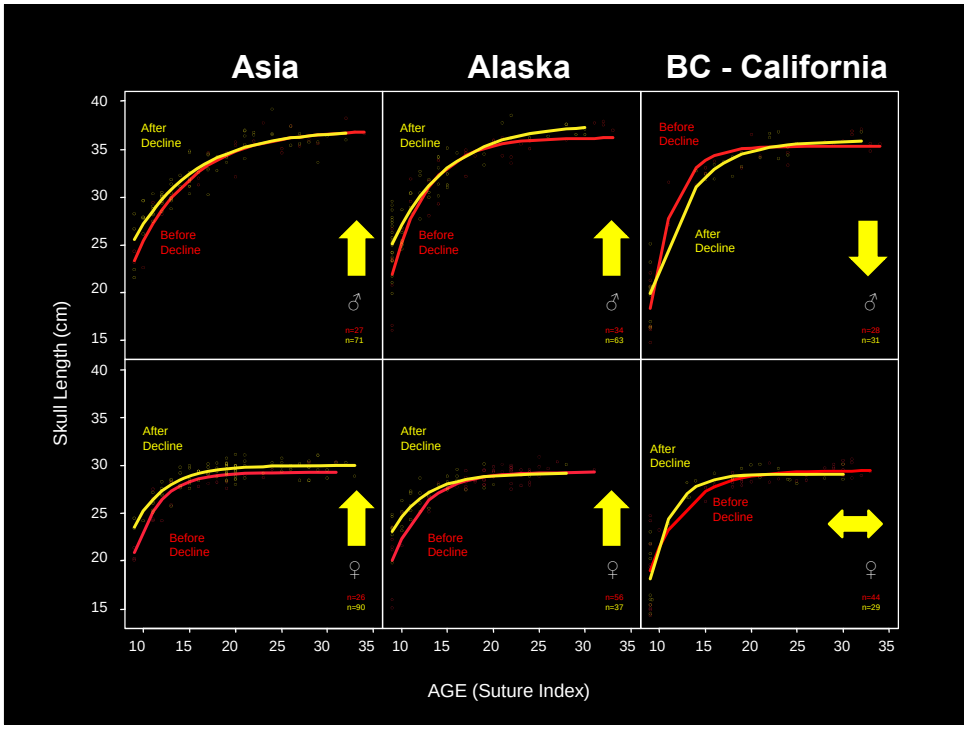


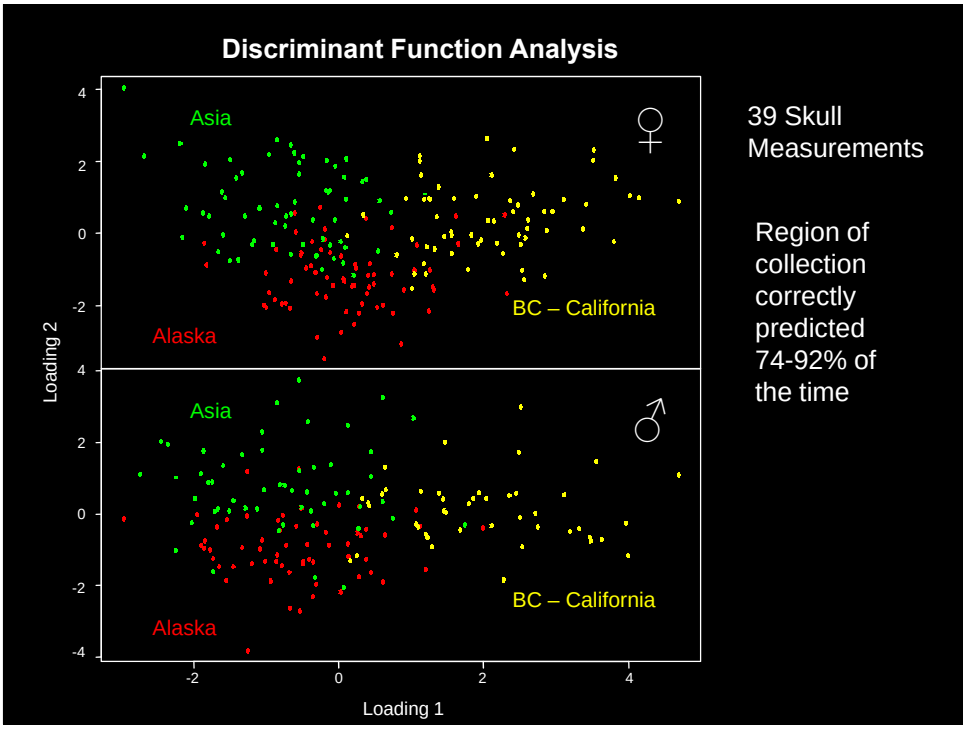
Male
n=135, r=0.865
Age=0.541*SI-3.520



Female
n=133, r=0.852
Age=0.742*SI-5.637


Age by tooth section
Age by Suture Index
n=136
n=133
n=299
n=326
Length of Skull (cm)
Years
Suture Index


Asia
Alaska
BC - California
After Decline
Before Decline
Skull Length (cm)
AGE (Suture Index)



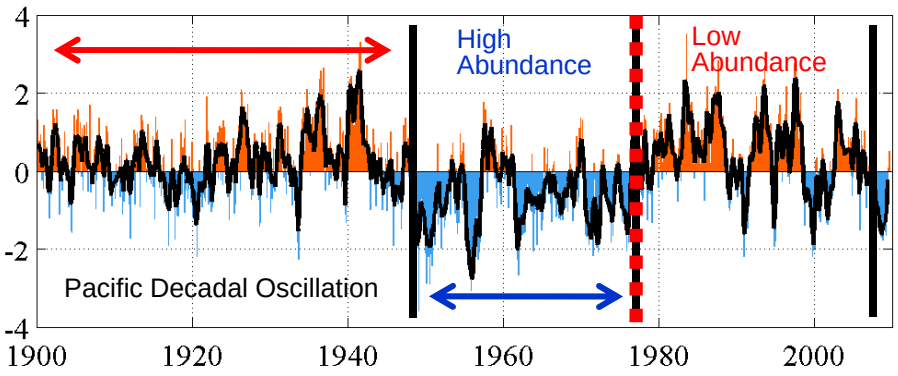
39 Skull Measurements

Region of collection correctly predicted 74-92% of the time

Why did the sea lions get bigger?

- Staying 1-3 y longer with their mothers
- Young don't have stomach capacity for low energy prey

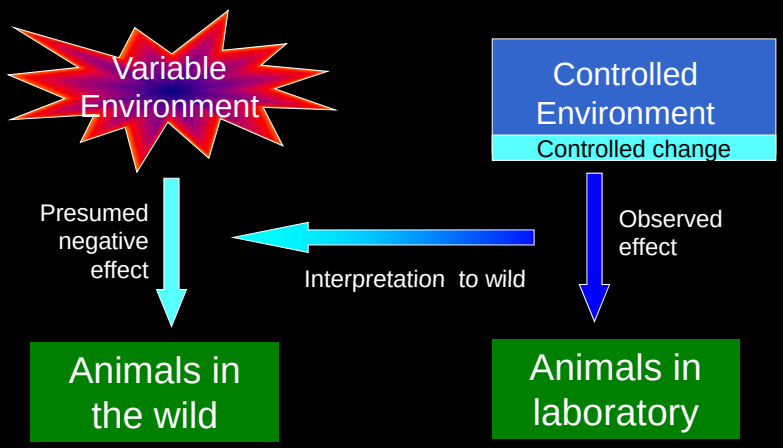
Steller sea lions evolved in a North Pacific Ocean that may shift periodically from one dominated by fatty fish (clupeids) to one dominated by lean fish (gadids)



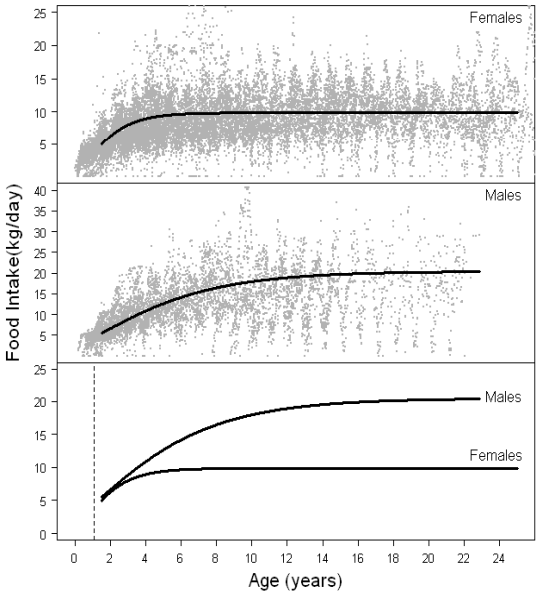
May explain the plasticity in the age at weaning

Sea lions in the Laboratory

To understand the reasons for the decline of marine mammal populations in the North Pacific and formulate science-based recovery plans.



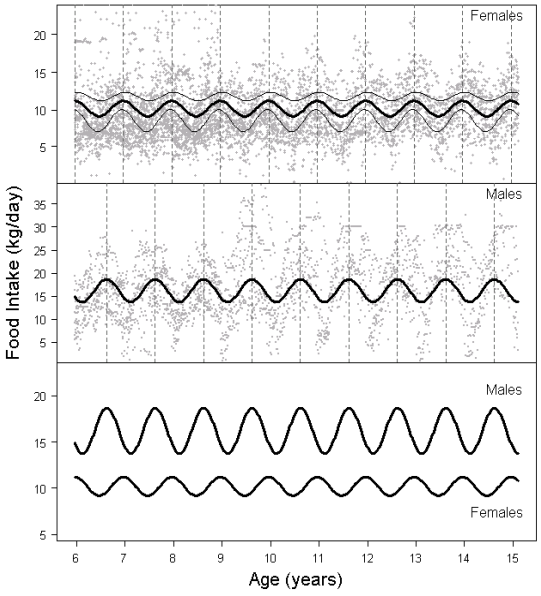
Captive Steller sea lions



Food intake

Allen (2009).

Captive Steller sea lions



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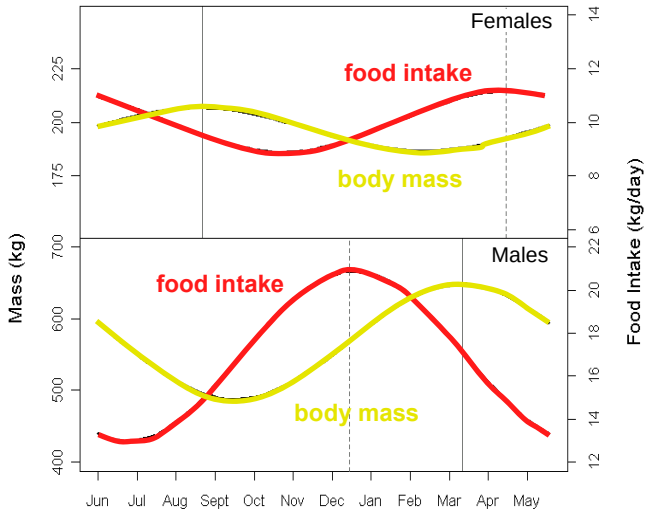
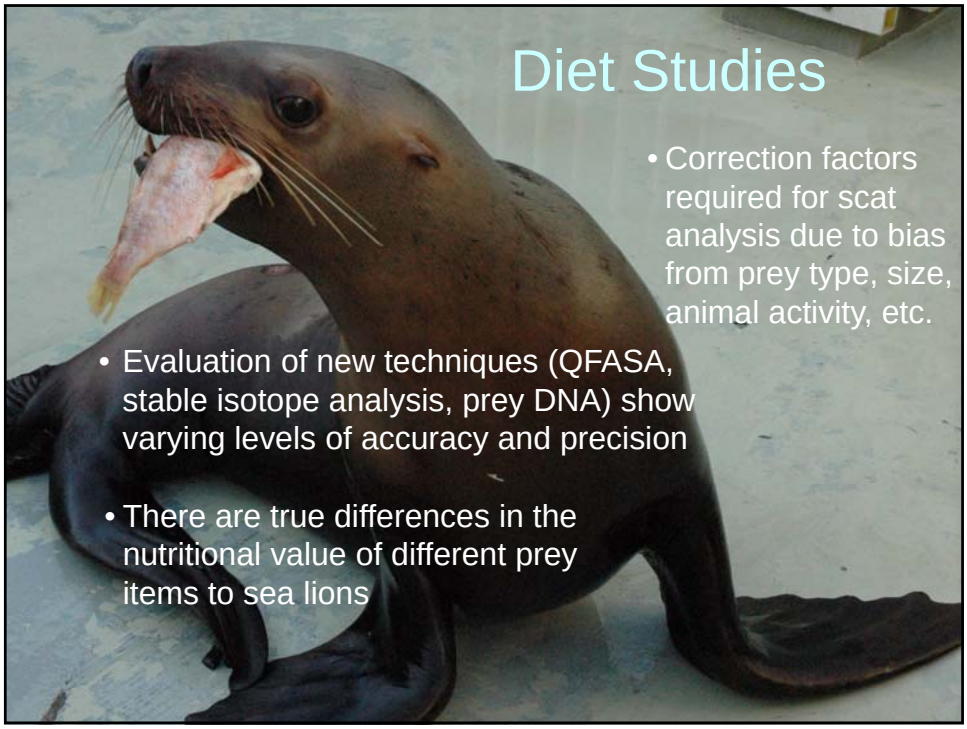


Allen (2009).

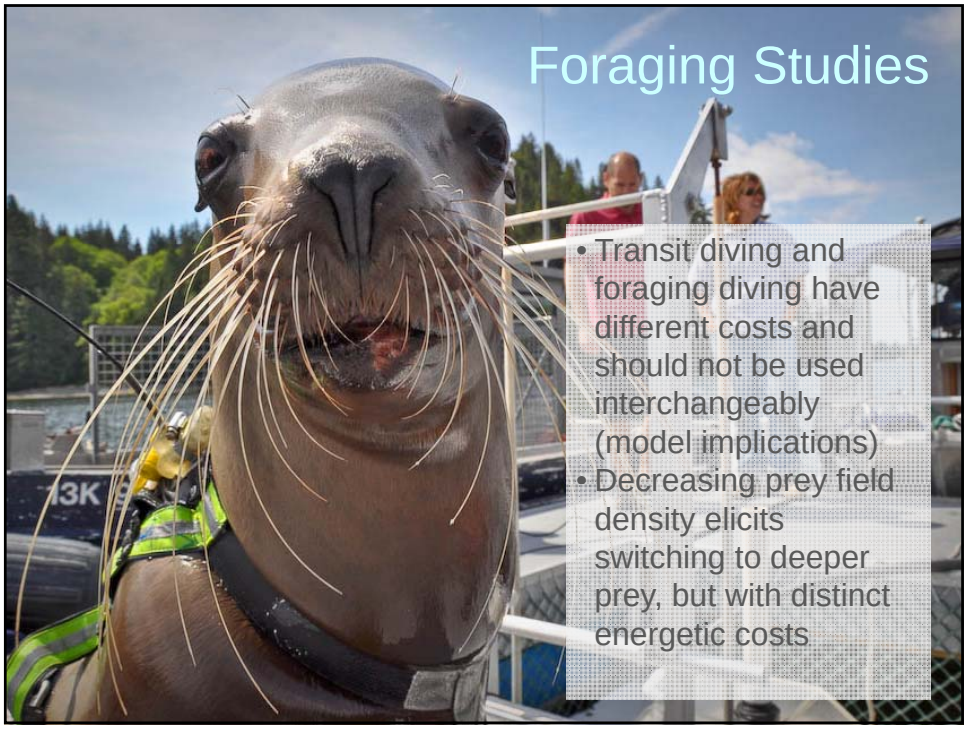


Diet Studies

- Correction factors required for scat analysis due to bias from prey type, size, animal activity, etc.
- Evaluation of new techniques (QFASA, stable isotope analysis, prey DNA) show varying levels of accuracy and precision
- There are true differences in the nutritional value of different prey items to sea lions

Foraging Studies

- Various measures can be used to identify or quantify costs of changes in behavior - heart rate, accelerometry, ODBA –
- but specific calibration coefficients are required



Bioindicators of Nutritional Status

- Some traditional indicators have limited value in stressed Steller sea lions (blubber depth, blood bio-chemistry)
- Others appear more promising (fecal and circulating hormones)

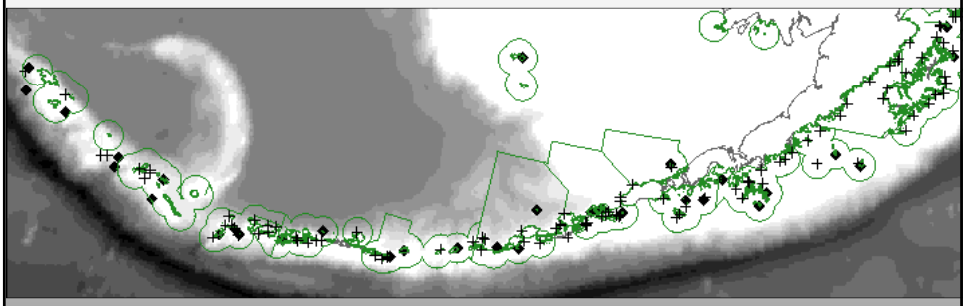
Effect of season on nutritional stress

- Effect of food restriction depends on seasonal conditions (even in captivity)
- More attuned to (natural) periodic food shortages in winter than in summer:
  - Recover faster in winter than in summer
  - Restriction in winter produces greater increase in cortisol (may be 'healthy' reaction to restriction)

Review
effect of diet changes

1. Different prey have different nutritional value
2. Quality matters *if* intake is insufficient (physiological or ecological limits)
3. Finite ability to adjust food intake (stomach)
4. Finite capacity for physiological compen-sation (metabolism)
5. Effect of nutritional stress depends on age, season, sex, extent of episode vs. recovery

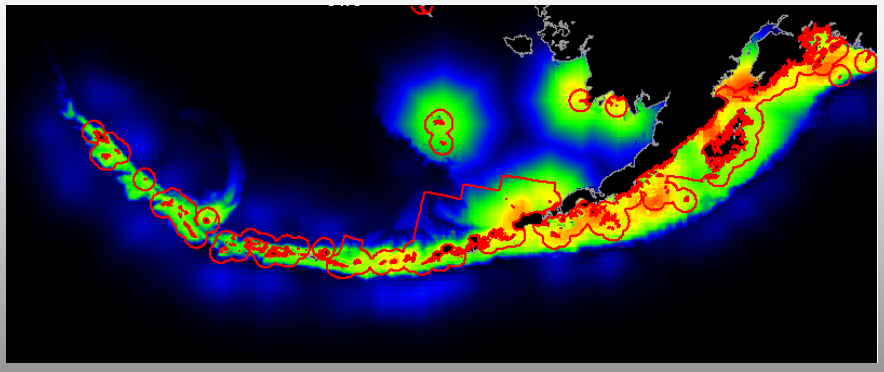
Critical Habitat



Qualitative Model

Critical Habitat

quantitative model

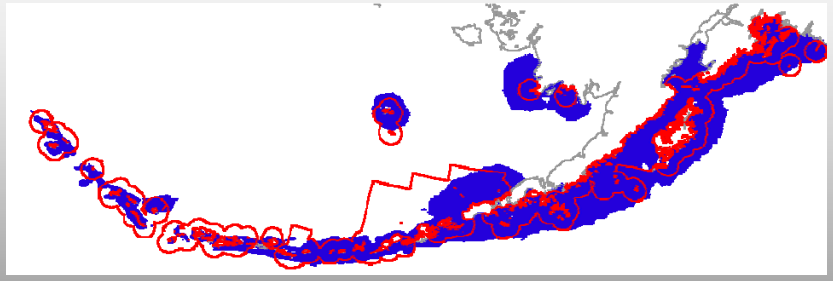


- Adult females, winter
- Distance to central place
- Depth

Gregr & Trites 2008. Marine Ecology Progress Series 365: 247-261

Alternative Critical Habitat definition

Adult females, winter



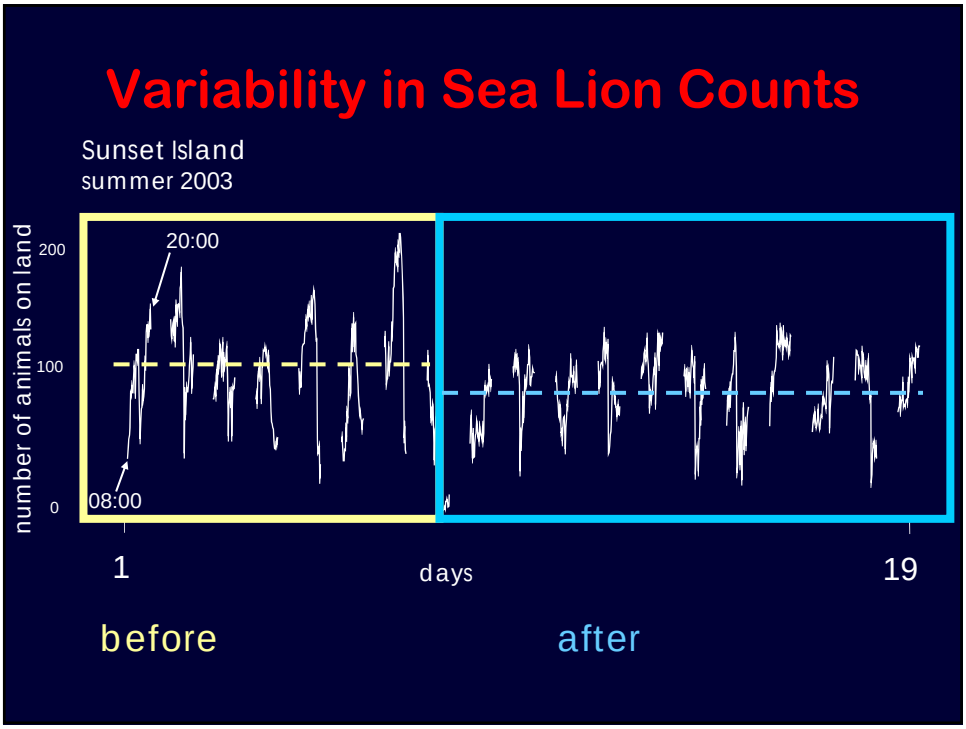
- Transparency allows review and debate
- Ecological assumptions can be investigated
- Costs of various closures can be explored

Critical Habitat Assessment

- Prey distributions are a good tool to assess critical habitat boundaries
- The amount of prey biomass enclosed within the critical habitat boundaries varied between region
- Critical habitat should be refined using prey distributions and seasonal and annual oceanographic information

Flinn et al. (in prep)

Variability in Sea Lion Counts



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